

## PATENT COOPERATION TREATY

PTO/PCT Rec'd 30 JUL 2001

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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference I-2-127.1WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US99/30652	International filing date (day/month/year) 23/12/1999	Priority date (day/month/year) 05/02/1999
International Patent Classification (IPC) or national classification and IPC H04B3/36		
Applicant INTERDIGITAL TECHNOLOGY CORPORATION et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 7 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the report</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>		
Date of submission of the demand 05/09/2000	Date of completion of this report 29.05.2001	
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Katruff, M Telephone No. +49 89 2399 2440	



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EXAMINATION REPORT

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**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1,2,4-9 as originally filed

3,3a as received on 01/03/2001 with letter of 27/02/2001

**Claims, No.:**

1-16 as received on 01/03/2001 with letter of 27/02/2001

**Drawings, sheets:**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

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the description,      pages:

the claims,      Nos.:

the drawings,      sheets:

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:  
**see separate sheet**

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Statement

Novelty (N)      Yes: Claims 1-16  
                      No: Claims none

Inventive step (IS)      Yes: Claims 1-16  
                      No: Claims none

Industrial applicability (IA)      Yes: Claims 1-16  
                      No: Claims none

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

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**Re Item I**

**Basis of the report**

**Claims 1, 12 and 16** are based on the corresponding original claims 1, 12 and 16 and Figs. 3 and 4.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following documents:

D1: US-A-5 634 191 (BEASLEY ANDREW) 27 May 1997 (1997-05-27)

2. a) The subject-matter of **claims 1, 12 and 16** of the present application is novel and involves an inventive step (Article 33(2) and (3) PCT) for the following reasons:

The subject-matter of **claims 1, 12 and 16** essentially differs from the prior art of D1 in that:

(i) the ground based equipment comprises:

- a compensation attenuator coupled to the transmit line

(ii) the mast head unit comprises:

- a second power level detector having means for transmitting the second power level signal to the ground based equipment

b) The problem to be solved by the present invention may therefore be regarded as how to improve the attenuation compensation for base stations having a remotely connected mast head unit.

c) The main advantage of the solution proposed in **claims 1, 12 and 16** can be seen in that the feed back signal can also be applied to compensate attenuation losses in the receiving path of the cable.

d) D1 refers to a self-adjusting RF repeater arrangement for wireless telephone systems. The repeater consists of a first part interfacing with the base station and detecting the transmit signal power level, quantizing and sending it to a second part. The second part interfacing with the RF part, demodulates the signal power

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level message and compares it with a detected value at the antenna input. However, D1 does not utilize a feed back from the second part to the first part as in the solution of the application.

**e) Claims 2-11 and 13-15 are dependent on claims 1 and 12, respectively, and as such also meet the requirements of the PCT with respect to novelty and inventive step.**

**Re Item VII**

**Certain defects in the international application**

**1. Rule 6 PCT**

**a)** Although **claims 1 and 16** have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, **claims 1 and 16** do not meet the requirements of Article 6 PCT.

The applicant did not file an amended set of claims defining the relevant subject-matter in terms of a minimum number of independent claims in each category followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).

**b)** The independent **claims 1, 12 and 16** are not in the two-part form in accordance with Rule 6.3(b) PCT, with those features known in combination from the prior art (document D1) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

**Re Item VIII**

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**Certain observations on the international application**

**1. Article 6 PCT**

The vague and imprecise statement in the description on page 9, last sentence ("spirit"), implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines, PCT/GL/3 III, 4.3a).

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signal level to the RF amplifier, which can result in overpowering or underpowering the RF amplifier. Overpowering the RF amplifier can cause interference with neighboring cell sites and can cause distortion of the transmitted signal which produces additional undesirable noise. Underpowering the RF amplifier can result in the transmission of a signal that is too weak to effectively communicate with the subscriber units within the cell area of the transmitter.

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The measurement of the power of an RF signal received by a base station is also critical to an effective CDMA system. Since this measurement is typically made at the ground station, variability in power loss through the cable also adversely affects the accuracy of the received power measurement.

Accordingly, there is a need for continuous, automatic compensation of the power loss in the cable between the antenna and the ground station in order to effectively control RF transmission power from the base station and more accurately to measure power received from subscriber units.

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## SUMMARY OF THE INVENTION

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The present invention compensates for the variability of transmitted RF signal levels in a CDMA system where a cable connects ground-based low signal level RF equipment with remotely located RF power amplification equipment. The RF signal level is measured at the ground-based RF equipment end of the cable and also at the RF power amplifier equipment end of the cable. Changes in the loss across the cable are compensated with variable attenuators.

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What is claimed is:

1. A cable loss compensation system for use in a base station having a mast head unit remotely connected to ground-based equipment by a cable, the system comprising:

5 a first power level detector coupled to a transmit signal line at the ground-based equipment;

a second power level detector coupled to the transmit signal line at the mast head unit;

a compensation attenuator coupled to the transmit signal line;

10 at least one controller for controlling the compensation attenuator based on a comparison of signals from the first and second power level detectors.

2. The cable loss compensation system as recited in claim 1 further comprising a second compensation attenuator coupled to a receive signal line.

3. The cable loss compensation system as recited in claim 2 wherein the controller controls the second compensation attenuator.

4. The cable loss compensation system as recited in claim 1 further comprising a power and control cable connected between the mast head unit and the ground-based equipment for carrying control signals between the first and second power level detectors.

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5. The cable loss compensation system as recited in claim 2 further comprising a first diplexer located in the ground-based equipment and coupled to the receive signal line, the transmit signal and the cable.

6. The cable loss compensation system as recited in claim 1 wherein the ground-based equipment further comprises a cell size attenuator coupled to the transmit signal line.

7. The cable loss compensation system as recited in claim 1 wherein the ground-based equipment further comprises a transmit pre-amplifier coupled to the transmit signal line.

8. The cable loss compensation system as recited in claim 2 further comprising a second diplexer located in the mast head unit and coupled to the receive signal line, the transmit signal line and the cable.

9. The cable loss compensation system as recited in claim 1 wherein the mast head unit further comprises a high power amplifier coupled to the transmit signal line.

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10. The cable loss compensation system as recited in claim 2 wherein the mast head unit further comprises a low noise amplifier coupled to the receive signal line.

11. The cable loss compensation system as recited in claim 2 wherein the mast head unit further comprises an antenna diplexer coupled to an antenna, the transmit signal line, and the receive signal line.

12. A method of compensating for cable loss in a wireless communication system having a high power amplifier located proximate an antenna, a pre-amplifier receiving a transmit signal located at a remote location, and a cable connected between the amplifiers, the method comprising the steps of:

5           detecting a first power level of the transmit signal at an output of the pre-amplifier;

          detecting a second power level of the transmit signal at an input of the high power amplifier;

          comparing the first and second power levels to determine a loss in the cable;

10           adjusting a cable compensation attenuator coupled to the pre-amplifier based upon the loss.

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13. The method of compensating for cable loss as recited in claim 12 wherein a gain of the cable compensation attenuator is increased if the loss is below a lower limit.

14. The method of compensating for cable loss as recited in claim 12 further comprising the steps of:

comparing the loss to upper and lower limits;

maintaining the gain of the cable compensation if the loss is between the 5 limits;

increasing the gain of the cable compensation if the loss is below the lower limit; and,

decreasing the gain of the cable compensation if the loss is above the upper limit.

15. The method of compensating for cable loss as recited in claim 12 further comprising adjusting the gain of a second cable compensation attenuator coupled to a receive signal based upon the loss.

16. A loss compensation system for use in a base station having at least one cable extending between first and second locations, the system comprising:

power level detection means for determining transmit signal power levels at each location;

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5 comparing means for comparing power levels from the power level detection means and for determining a loss between the two locations; attenuating means for controlling the power level of the transmit signal; and, control means responsive to the comparing means for controlling the attenuating means.